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Herbert Osborn

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LABORATORY NOTES IN ZOOLOGY.

HERBERT OSBORN.

It is my purpose, in these notes, to call attention to some matters of experience in laboratory work which may be of service to other teachers and also to place on record the results of some studies by students that appear to be worthy of preservation.

Laboratory work in zoology has been carried on at the Agricultural College since 1876, and for nearly all of that time under my own supervision, so that while my own specialty has kept me busy in other lines some notes from the experience of these years may be of service to teachers who may be situated in similar localities. It is needless to suggest that work in an inland laboratory will naturally take somewhat different lines than a seaside laboratory.

We first began the use of marine material in our laboratory about ten years ago and at that time there was but one place where material suitably prepared and at prices consistent with laboratory work could be secured. Now a number of seaside laboratories as well as individual collectors furnish excellent material and no laboratory need want in this direction. Hydroids, starfishes, sea urchins and squids seem most essential as representatives of groups unknown away from the sea coast. The ease with which such material may now be had, the full treatment of these types in various guides and convenience of dissection may, however, almost be considered a danger as it may tend to the neglect of our common inland forms which it may, possibly, be a little more inconvenient to secure just at the time they are wanted. I believe we should be careful to avoid this danger, for students, especially those who may become teachers themselves, should be impressed with the fact that material for study is available at any point, and so far as they may be representatives of the groups to be studied, the species close at hand should be used.

The protozoans are of course available in every stagnant pool, but it is sometimes desirable to be sure of abundant supply of amoeba and other forms at a certain time, and this may be accomplished by keeping the contents of jars over from year to year, allowing them to dry up before winter or when not in use. For a number of years I kept a particular block of wood that furnished amoeba regularly for a number of different classes. It was allowed to dry in autumn, the ooze with which it was coated of course remaining, and then two or three weeks before the material was wanted the jar in which it was kept was partly filled with water, and in due time an abundant crop of amoebae could be secured.

The earthworm, clam and crayfish are of course standbys, and the only point I might suggest here is to have an abundant supply of these preserved, as it is sometimes difficult to secure these in abundance at just the time they are wanted. It is naturally demoralizing to a class to be short of material, and with classes numbering forty or fifty the question sometimes becomes a serious one. This is especially true in case the time for these subjects falls within a period of drouth when the earthworms may be out of reach except in favored spots, the crayfishes hidden in some very moist corner, or, with the clams, to be found only in some pool that has survived the drouth. Such material may be kept fresh in good sized tanks or aquaria, or preserved in alcohol; some at least should be prepared in the latter way for use in dissecting certain parts. I have a large cement lined tank sunk in the floor of the basement of the building occupied by the laboratory, which is very convenient for keeping clams, crayfishes, frogs and fishes, and it also forms an attractive feature, being as much sought for as the museum cases by visitors, especially by children.

I find in the vicinity of Ames that the common Differential Locust (*Melanoplus differentialis*) forms one of the most available species for laboratory work. It is much larger than the more common *femur-rubrum*, hence more easily studied by the beginner and is more easily collected in quantity than the large species of *Acridium*.

For fishes I generally find it most convenient to order through the meat market undrawn fishes of eight to twelve inches in length. Sometimes we get fresh mackerel or other marine fishes, but more commonly lake or river species.

Snakes and turtles have to be secured as they turn up, but students usually secure enough to answer the purpose. Turtles are not kept on the market with us, and to order them from a distance is rather expensive.

For birds, pigeons, or in case these are wanting, blackbirds or robins serve the purpose.

If classes are not too large the embryology of the chick forms a most entertaining and instructive study, but the work is somewhat difficult to manage except with students somewhat advanced, and even then it is best not to attempt to direct too many at once. The eggs may be incubated artificially, but about the most satisfactory way is to use a hen, especially if a good, persistent setter is available. Sometimes one can be kept busy for five or six weeks and in this time incubate a large number of eggs.

For small mammal the most available, easily secured and satisfactory with us is the striped ground squirrel (*Spermophilus tridecemlineatus*). These are very abundant on the campus, may be caught very quickly by the use of slipnoose cord and without any injury to any part of the body as occurs with rabbits if shot. This makes them available for injection or for any treatment desired. Rats I have seldom used, as with us it is more bother to secure them than squirrels, but of course rats, rabbits, cats and dogs are used on occasion. It seems to me fully as well to use a species different from the one described in the guide, if a guide is used, since it throws the student on his own resources, incites comparative study and prevents too close following of the guide, either in description or drawing, in fact the main object of the guide is to ensure attention to all structures that should be studied, and to avoid waste of material, in case the animal is

one not to be had in unlimited quantity. Also to secure careful dissecting and not mere cutting and slashing.

A "Study of the Brain of the Common Striped Squirrel," by Mr. T. J. Kerr of the class of 1890, yielded the following results that may be worthy of record, though it needs the drawings prepared in the study to fully exhibit the results.

The brain was studied especially in comparison with that of the rabbit as described by Parker (Zootomy, pp. 365-379).

The brain in general differs from that of *L. cuniculus* in being a little broader in proportion to its length. The olfactory lobes are smaller, shorter and more angular in outline. As the depressions on the ventral surface between the lobes of the cerebral hemispheres and the white bands connecting the olfactory lobes with the temporal are very shallow, the surface is smoother than that of *L. cuniculus*. The frontal and parietal lobes do not show on the ventral surface as much as they do in the rabbit.

The number of convolutions in each division of the cerebellum varies in different brains. The least number observed in the superior vermix was six, the greatest eleven, the average being about eight. The least number for each lateral lobe seven, the greatest fifteen, the average being about ten. For each flocculus the least number was four, the greatest eight, the average being about six. The vertical longitudinal sections present the usual tree-like appearance or arbor vitæ. The vertical transverse sections are less tree-like in appearance.

In *L. cuniculus* there is a slight elevation on which the pituitary body rests, but in *S. tridecemlineatus* there is a slight depression, a sort of nest.

The corpus callosum is a strong white transverse band connecting the cerebral hemispheres. It is about half as long as the cerebrum, instead of one-third as long, as in *L. cuniculus*.

The peduncles of the pineal body are thin white bands on the posterior two-thirds of the upper surface of the optic thalami, instead of one-half as in *L. cuniculus*. The two peduncles unite at the posterior boundary of the thalami and then pass backward and upward to the pineal body.

The optic lobes or corpora quadrigemina are two pair of rounded lobes lying just above the crura cerebri, just posterior to the optic thalami and third ventricle, just below the hippocampi majores and dorso-posterior part of the parietal lobes and just anterior to the cerebellum. The nates, the larger pair, lie almost entirely above the testes, instead of anterior to, as in *L. cuniculus*. As seen from behind after removing the cerebellum the testes are transversely elongated as in the rabbit.

The brain of the pocket gopher, studied by Mr. W. E. Harriman of the class of 1893, was compared particularly with that of the rabbit, as detailed by Parker (Zootomy, pp. 376-397), and with that of the striped gopher as given by Mr. Kerr in the paper previously quoted.

The brain of the pocket gopher (*Geomys bursarius*) is more nearly the shape of the brain of *L. cuniculus* than of *Spermophilus tridecemlineatus*, its width being less than is the same dimension in *S. tridecemlineatus*. However, it resembles the latter in point of there being comparatively smaller parietal lobes than in *L. cuniculus*. The dimensions, as averaged from measurements of thirteen brains, are as follows: Antero-posterior (from anterior end of olfactory lobe to posterior end of medulla) twenty-six milli-

meters. Lateral (through base of cerebral hemispheres) seventeen millimeters. Dorso-ventral (through median commissure), eleven millimeters, the largest 30x20x14 mm. The average weight of nine brains is three and five-tenths grams, the heaviest 3.922, lightest, 2.3012.

On the dorsal aspect of the pons at the end of the fourth ventricle is a curtain like affair at right angles to the longitudinal dimension of the ventricle called the valve of Vieussens. In *G. bursarius* this portion is very small. It appears to be attached to the anterior crura of the cerebellum. Anterior to this valve of Vieussens are two bodies, each deeply cleft or lobed into two hemispheres. They correspond to the Corpora quadrigemina of higher animals. The anterior body might be termed the tubercular nates, the posterior the tubercular testes. Still more anteriorly situated are two masses which are longer comparatively in *G. bursarius* than in either *S. tri-decemlineatus*, or *L. cuniculus*. They are the Thalami optici. * * *

The cerebellum is rather spheroidal in shape, and in mass compares with the cerebrum as about one to four. In the higher animals this portion of the encephalon is divided into two distinct hemispheres, each hemisphere being in turn cleft into several lobes. But in *G. bursarius* it is more accurate to consider it as composed of three distinct lobes, called respectively, the central lobe and the two lateral lobes. Just lateral to these parts, on either side, is a peculiar body coiled upon itself, somewhat like a snail shell, called the Flocculus. * * *

The surface shows a sort of convolution being traversed in a general transverse direction by numerous curved furrows or sulci, which vary in depth in different parts. In this respect the cerebellum is quite similar to that of higher forms, which is also true of its structure and the arrangement of the gray and white matter which on cross section shows the characteristic arbor vitæ appearance.

On the ventral surface of the cerebrum, extending well forward from about the center of each hemisphere, are the olfactory lobes; they protrude about two to four millimeters beyond the frontal lobes.

The eighth pair, or auditory nerves, are large comparatively, and originate in a groove between the olivary body and restiform bodies at the posterior border of the pons.

The earthworms of the State were studied by Miss Vinnie Williams of class of 1893, with the result of finding, according to her determination, two distinct species in the State.

These were the *Allolobophora turgida*, specimens of which were secured from Tama county, and the *Lumbricus rubellus*, species of which were obtained from Chickasaw and Poweshiek counties.

Doubtless other species occur, but apparently no one has hitherto recorded any determinations. The species most common at Ames is probably the *Allolobophora turgida*, but with ordinary preparation the positive separation of species is difficult and few have been examined when prepared so as to permit rigid examination.